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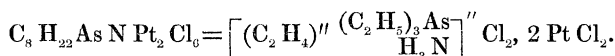
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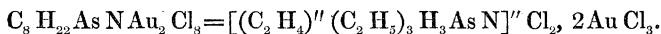
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Gold-salt.—Yellow compound precipitated from the dichloride obtained in the previous platinum-determination, on addition of tri-chloride of gold, soluble in hydrochloric acid, deposited from this solution in golden-yellow plates of the composition

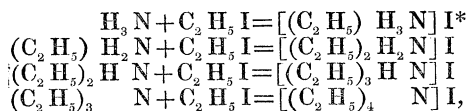


I have also made a few experiments on the action of dibromide of ethylene upon triethylstibine. The reaction is slow, and requires long-continued digestion at temperatures higher than that of boiling water. The tubes invariably contained much gas; and the product of the reaction proved to be a complex mixture of several compounds, many of them secondary, which in no way invited me to a more minute examination of this process. I omit to quote the few platinum- and chlorine-determinations which were made, since they do not admit of a simple interpretation.

IV. "Contributions towards the History of the Monamines."—

No. IV. Separation of the Ethyl-Bases. By A. W. HOFMANN, LL.D., F.R.S. Received November 28, 1860.

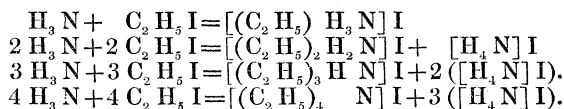
The preparation of the ethyl-bases by the action of ammonia upon iodide of ethyl, presents a difficulty which greatly interferes with the general application of this otherwise so convenient method. This difficulty consists in the simultaneous formation of all the four ethyl-bases. The equations



are an ideal representation of the four different phases through which ammonia passes during its transformation into iodide of tetrethyl-ammonium. In practice it is found impossible to carry out this transformation in the several steps indicated by these equations. The first substitution-product, generated as it is in the presence of the agent of substitution, is immediately acted upon again, the second

* H=1; O=16; C=12, &c.

product being formed, which in its turn may be converted into the third and even into the fourth compound. The following equations represent perhaps more correctly the final result of the several changes which are accomplished in the reaction of ammonia on iodide of ethyl.



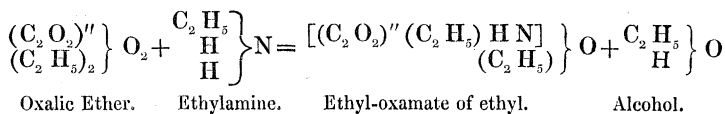
The mixture of iodides, when submitted to the action of potassa, yields ammonia, ethylamine, diethylamine, and triethylamine, the hydrate of tetrethylammonium, which is liberated, splitting into ethylene, triethylamine, and water. The separation of the three ethyl-ammonias presents unusual difficulties. The differences between their boiling-points being rather considerable,

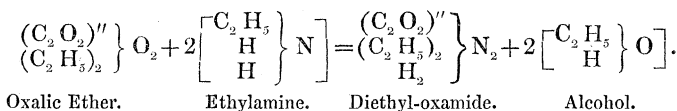
Ethylamine, boiling-point	18°
Diethylamine, „ „	57°·5
Triethylamine, „ „	91°

it was thought that they might be readily separated by distillation. Experiments made with very large quantities showed, however, that even after ten fractional distillations the bases were far from being pure.

After many unsuccessful attempts, I have found a simple and elegant process by which the three ethyl-bases may be easily and perfectly separated. This process consists in submitting the anhydrous mixture of the three bases to the action of anhydrous oxalate of ethyl. By this treatment, ethylamine is converted into *diethyl-oxamide*, a beautifully crystalline body very difficultly soluble in water, diethylamine into *ethyl-oxamate of ethyl*, a liquid boiling at a very high temperature, whilst triethylamine is not affected by oxalic ether

By the action of oxalic ether upon ethylamine, two substances may be formed, viz. *ethyl-oxamate of ethyl* and *diethyl-oxamide*.





In practice it appears that the *second* of these compounds only is produced.

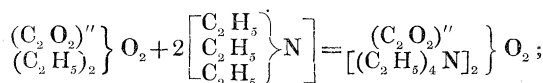
In the action of oxalate of ethyl upon diethylamine, two similar phases may be distinguished capable of producing respectively

Diethyl-oxamate of ethyl. $\left[\begin{smallmatrix} (\text{C}_2 \text{O}_2)'' \\ (\text{C}_2 \text{H}_5)_2 \end{smallmatrix} \text{N} \right\} \text{O}$, and

Tetrethyl-oxamide $\left\{ \begin{smallmatrix} (\text{C}_2 \text{O}_2)'' \\ (\text{C}_2 \text{H}_5)_2 \\ (\text{C}_2 \text{H}_5)_2 \end{smallmatrix} \right\} \text{N}_2$.

In practice the *first* of these two compounds only is generated.

The action of oxalate of ethyl upon triethylamine might have involved the formation of the secondary oxalate of tetrethylammonium,



under the circumstances under which I have worked, the two substances do not combine.

The product of the reaction of oxalate of ethyl upon the mixture of the ethyl-bases, when distilled in the water-bath, yields *triethylamine free from ethylamine and diethylamine*.

The residue in the retort solidifies on cooling into a fibrous mass of crystals of diethyloxamide, which are soaked with an oily liquid. They are drained from the oil and recrystallized from boiling water. Distilled with potassa, these crystals furnish *ethylamine free from diethylamine and triethylamine*.

The oily liquid is cooled to 0°, when a few more of the crystals are deposited; it is then submitted to distillation. The boiling-point rapidly rises to 260°. What distils at that temperature is pure diethyl-oxamate of ethyl, from which, by distillation with potassa, *diethylamine free from ethylamine and triethylamine* may be obtained.

The Society then adjourned to Thursday, January 10, 1861.